KOH CONCENTRATION EFFECT ON THE CYCLE LIFE OF NICKEL-HYDROGEN CELLS. IV. RESULTS OF FAILURE ANALYSES

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Effects of KOH concentrations on failure modes and mechanisms of nickel-hydrogen cells have been studied using long cycled boiler plate cells containing electrolytes of various KOH concentrations ranging 21 to 36%. Life of these cells were up to 40,000 cycles in an accelerated low earth orbit (LEO) cycle regime at 80% depth of discharge. An interim life test results were reported earlier in J. Power Sources, 22, 213-220, 1988. The present report will discuss the results of final life test, end-of-life cell performance, and teardown analyses. These teardown analyses included visual observations, measurements of nickel electrode capacity in an electrolyte-flooded cell, dimensional changes of cell components, SEM studies on cell cross section, BET surface area and pore volume distribution in cycled nickel electrodes, and chemical analyses.

Cycle life of a nickel-hydrogen cell was improved tremendously as KOH concentration was decreased from 36 to 31% and from 31 to 26% while effect of further concentration decrease was complicated as described in our earlier report. Failure mode of high concentration (31 to 36%) cells was gradual capacity decrease, while that of low concentration (21 to 26%) cells was mainly formation of a soft short. Long cycled (25,000 to 40,000 cycles) nickel electrodes were expanded more than 50% of the initial value, but no correlation was found between this expansion and measured capacity. All electrodes cycled in low concentration (21 to 26%) cells had higher capacity than those cycled in high concentration (31 to 36%) cells.